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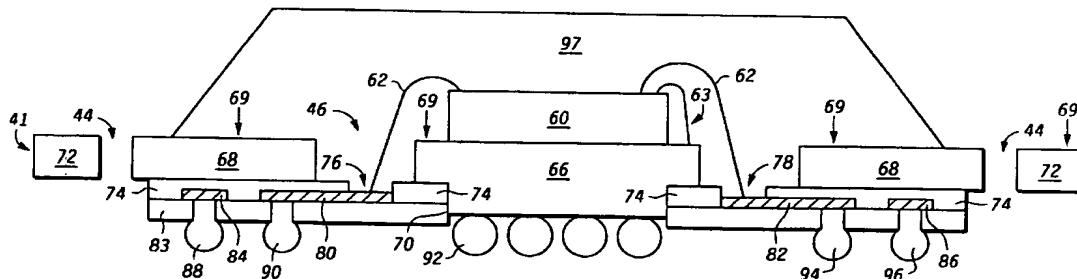
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(54) Title: A PACKAGED INTEGRATED CIRCUIT HAVING A HEAT SPREADER AND METHOD THEREFOR



(57) Abstract: An integrated circuit (60) is packaged, in one embodiment, by wire bonding to pads (76, 78) supported by tape (83). The tape (83) also supports traces (80, 82) that run from the wire bonded location (76) to a pad for solder balls (90, 94). A heat spreader (69) is thermally connected to the integrated circuit (60) and is located not just in the area under the die (60) but also extends to the edge of the package in the area outside the wire bonding location. This outer area (68) is thermally connected to the area (66) under the die (60) by thermal bars (66) that run between some of the wire bond locations (76, 78). During the manufacturing of the package the heat spreader (69) is connected to slotted rails by tie bars (48, 50, 52, 54). During singulation, the tie bars (48, 50, 52, 54) are easily broken or sawed because they are significantly reduced in thickness from the thickness of the heat spreader (66) as a whole.



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*For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.*

# INTERNATIONAL SEARCH REPORT

International application No.

PCT/US04/11873

## A. CLASSIFICATION OF SUBJECT MATTER

IPC(7) : H01L 23/495, 23/48, 23/52, 29/40, 23/28, 21/44, 21/48, 21/50, 21/30, 21/46, 21/301

US CL : 438/111,112,458,459,461,462,68,113,114,460,463,464,465,for386,for387; 257/668,670,675,676,784,787

According to International Patent Classification (IPC) or to both national classification and IPC

## B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

U.S. : 438/111,112,458,459,461,462,68,113,114,460,463,464,465,for386,for387; 257/668,670,675,676,784,787

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched  
NONE

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)  
EAST

## C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 5,914,531 A (TSUNODA et al) 22 June 1999 (22.06.1999), column 6, line 1 to column 8, line 11; column 9, lines 19-24 and 42-46; and column 9, line 65 to column 10, line 6.	1-15, 19-21 and 23-31
X	US 2003/0001252 A1 (KU et al) 02 January 2003 (02.01.2003), paragraphs 10-12, 19-24, 31, 33 and 49.	36-39
X	US 6,281,568 B1 (GLENN et al) 28 August 2001 (28.08.2001), column 4, line 26 to column 5, line 6; column 10, line 54 to column 12, line 53; and column 13, lines 1-19.	15-18
X	US 6,242,281 B1 (MCLELLAN et al) 05 June 2001 (05.06.2001), column 6, line 33 to column 7, line 15.	15 and 22
A,P	US 20040063272 A1 (TSUNODA et al) 01 April 2004 (01.04.2004), entire document.	1-31 and 36-39
A	US 2002/0171144 A1 (ZHANG et al) 21 November 2002 (21.11.2002), entire document.	1-31 and 36-39
A,E	US 6,746,897 B2 (FUKUTOMI et al) 08 June 2004 (08.06.2004), entire document.	1-31 and 36-39
A,P	US 6,686,226 B1 (TSUNODA et al) 03 February 2004 (03.02.2004), entire document.	1-31 and 36-39
A	US 6,365,432 B1 (FUKUTOMI et al) 02 April 2002 (02.04.2002), entire document.	1-31 and 36-39



Further documents are listed in the continuation of Box C.



See patent family annex.

Special categories of cited documents:	
"A" document defining the general state of the art which is not considered to be of particular relevance	"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
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"O" document referring to an oral disclosure, use, exhibition or other means	"&" document member of the same patent family
"P" document published prior to the international filing date but later than the priority date claimed	

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## C. (Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US 6,114,192 B1 (TSUNODA et al) 05 September 2000 (05.09.2000), entire document.	1-31 and 36-39
A	US 5,976,912 A (FUKUTOMI et al) 02 November 1999 (02.11.1999), entire document.	1-31 and 36-39
A	US 5,717,252 A (NAKASHIMA et al) 10 February 1998 (10.02.1998), entire document.	1-31 and 36-39
A,P ✓	US 2003/0203539 A1 (ISLAM et al) 30 October 2003 (30.10.2003), entire document.	1-31 and 36-39
A,E	US 6,770,959 B2 (HUANG et al) 03 August 2004 (03.08.2004), entire document.	1-31 and 36-39
X	US 6,759,737 B2 (SEO et al) 06 July 2004 (06.07.2004), column 1, line 1 to column 10, line 65.	1-31 and 36-39
A,P	US 6,611,047 B2 (HU et al) 26 August 2003 (26.08.2003), entire document.	1-31 and 36-39
A,P	US 6,585,905 B1 (FAN et al) 01 July 2003 (01.07.2003), entire document.	1-31 and 36-39
A,P	US 6,573,612 B1 (MIYATA) 03 June 2003 (03.06.2003), entire document.	1-31 and 36-39
A	US 6,521,987 B1 (GLENN et al) 18 February 2003 (18.02.2003), entire document.	1-31 and 36-39
A	US 6,498,099 B1 (McLellan et al) 24 December 2002 (24.12.2002), entire document.	1-31 and 36-39
A	US 6,352,879 B1 (FUKUI et al) 05 March 2002 (05.03.2002), entire document.	1-31 and 36-39
A	US 6,282,094 B1 (LO et al) 28 August 2001 (28.08.2001), entire document.	1-31 and 36-39
A	US 6,109,369 A (CRUMLY et al) 29 August 2000 (29.08.2000), entire document.	1-31 and 36-39
A	US 5,987,744 A (LAN et al) 23 November 1999 (23.11.1999), entire document.	1-31 and 36-39
A ✓	US 5,874,784 A (AOKI et al) 23 February 1999 (23.02.1999), entire document.	1-31 and 36-39
A	US 5,854,094 A (FUJII et al) 29 December 1998 (29.12.1998), entire document.	1-31 and 36-39
A	US 5,811,876 A (HAGA et al) 22 September 1998 (22.09.1998), entire document.	1-31 and 36-39
A	US 5,693,572 A (BOND et al) 02 December 1997 (02.12.1997), entire document.	1-31 and 36-39
A	US 5,285,352 A (PASTORE et al) 08 February 1994 (08.01.1994), entire document.	1-31 and 36-39
A	US 5,281,556 A (SHIMIZU et al) 25 January 1994 (25.01.1994), entire document.	1-31 and 36-39
A	US 5,216,278 A (LIN et al) 01 June 1993 (01.06.1993), entire document.	1-31 and 36-39
A	US 5,087,961 A (LONG et al) 11 February 1992 (11.02.1992), entire document.	1-31 and 36-39
A	US 4,771,330 A (LONG) 13 September 1988 (13.09.1988), entire document.	1-31 and 36-39

# INTERNATIONAL SEARCH REPORT

International application No.

PCT/US04/11873

## Box No. II Observations where certain claims were found unsearchable (Continuation of item 2 of first sheet)

This international search report has not been established in respect of certain claims under Article 17(2)(a) for the following reasons:

1. ☐ Claims Nos.:  
because they relate to subject matter not required to be searched by this Authority, namely:
2. ☒ Claims Nos.: 32-35  
because they relate to parts of the international application that do not comply with the prescribed requirements to such an extent that no meaningful international search can be carried out, specifically:  
Please See Continuation Sheet
3. ☐ Claims Nos.:  
because they are dependent claims and are not drafted in accordance with the second and third sentences of Rule 6.4(a).

## Box No. III Observations where unity of invention is lacking (Continuation of item 3 of first sheet)

This International Searching Authority found multiple inventions in this international application, as follows:

1. ☐ As all required additional search fees were timely paid by the applicant, this international search report covers all searchable claims.
2. ☐ As all searchable claims could be searched without effort justifying an additional fee, this Authority did not invite payment of any additional fee.
3. ☐ As only some of the required additional search fees were timely paid by the applicant, this international search report covers only those claims for which fees were paid, specifically claims Nos.:
4. ☐ No required additional search fees were timely paid by the applicant. Consequently, this international search report is restricted to the invention first mentioned in the claims; it is covered by claims Nos.:

Remark on Protest

☐

The additional search fees were accompanied by the applicant's protest.

☐

No protest accompanied the payment of additional search fees.